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By

C. J. WILLARD, D. F. BEARD AND L. E. THATCHER

Department of Agronomy

The Ohio State University and
The Ohio Agricultural Experiment Station

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C. J. WILLARD, D. F. BEARD, AND L. E. THATCHER
Department of Agronomy, The Ohio State University and Ohio Agricultural Experiment Station

With a poor crop of red clover seed and the largest supply of alfalfa seed in our history, it seems assured that alfalfa will be considerably cheaper than red clover in 1948. This has happened several times in the last 25 years. Now, this condition may continue for some years. An important factor in the increased alfalfa seed production is the reduction in insect losses by the use of DDT in the western states. Similar gains for red clover seed production may be worked out in the future, but are not yet in sight.

Consequently, now and for the next few years, the economical thing to do is to replace a considerable share of the red clover seed with alfalfa. A mixture of alfalfa and red clover is better than either one alone for practically any situation in Ohio. Three or 4 pounds of red clover with 6 or 7 pounds of alfalfa will produce a meadow that can be left for 2 years, if desired, with a legume in the second year hay and a good legume sod to plow under. Since alfalfa starts best in dry seasons and red clover in wet seasons, the mixture is surer to give a stand of some legume than either one alone. Any soil that will produce really good red clover will produce some alfalfa and the mixture can be profitably used on soils which are not adapted to pure alfalfa. For either red clover or alfalfa to be successful, soils which have a pH below 6.5 should be limed.

What Kind of Alfalfa?—There are numerous varieties and sources of alfalfa seed on the market at an almost equal variety of prices. What should the Ohio farmer buy?

First of all, in Ohio or anywhere, locally produced seed is likely to be superior to any imported seed except the wilt-resistant varieties to be discussed later. However, very little alfalfa seed has been produced in Ohio in the last 2 years.

Recommendations for Northern Ohio.—For the first 2 years in northern Ohio, and usually for the first 3 years, variegated varieties, such as Grimm, Hardigan, Baltic, Cossack, and Ontario Variegated, will outyield common alfalfas by a margin of 5 to 10 per cent. This is *not* due to their greater winter hardiness, although the variegated varieties are more resistant to killing by the direct effect of cold than are the common varieties. They have simply shown a relatively greater yielding ability in the first year than common alfalfas, for no one specific reason that can be singled out. In a variety of ways they are somewhat better adapted to that region than are the

common alfalfas. The term variegated refers to the flower color of this group of alfalfas. They tend to have varicolored flowers, especially yellows, whites, and purples, instead of the blue of common alfalfa.

These varieties are recommended for the northern part of the state, especially the northern one-third. How much more one can afford to pay for them than for common alfalfas can be determined by figuring the value of a 5 to 10 per cent increase in hay yields for 2 years.

Just How Have These Varieties Compared in Yield in Ohio?—As an average of all variety tests conducted in Ohio up to 1940, we have the following percentage yields with the yield of Northwestern Grimm as 100; Variegated alfalfa produced in Ohio, 106; Ontario Variegated, 103; Hardigan, 104; Cossack, 102; Baltic, 101; Montana Common, 98; Dakota Common, 97; Nebraska Common and Oklahoma Common, 97.5; Kansas Common, 95.5; Idaho Common and Utah Common, 93; New Mexico Common, 90; Southern California Common, 78; Arizona Common, 73; Argentine Common, 88. (This is the best record in the Corn Belt for Argentine alfalfa; it is influenced by one exceptionally favorable test.)

These tests were mostly conducted in the northern part of the state, none farther south than Columbus, and form the basis for these "northern" recommendations.

Recommendations for Southern Ohio.—In southern Ohio and farther south, variegated varieties yield less than common alfalfas. This is due in part to the fact that the variegated varieties are adapted to the long summer days of the North, and with the shorter days, characteristic of the south, the plants of the variegated varieties go dormant earlier and yield much less at the last cutting than common alfalfas.

Consequently, the farther south we go, the less the advantage for the variegated alfalfas. South of parallel 40° (Columbus), adapted common alfalfas from Nebraska, Kansas, and Oklahoma are recommended. Alfalfas from Utah and Idaho are almost but not quite so good. The difference is 2 or 3 per cent.

Obviously, there must be a belt in central Ohio where it makes very little difference whether common or variegated seed is purchased. That belt cannot be accurately located but it probably extends some distance north and south of Columbus.

Recommendations for All of Ohio.—Avoid non-hardy alfalfas. These include common alfalfas from southern California, Arizona, New Mexico, and the Argentine. Considerable quantities of Argen-

tine seed were imported last year and some of it is still being offered. Avoid it. It is stained 10 per cent orange-red. Southern California and Arizona seed, which are equally as unsatisfactory, can be identified only by the certificate of origin on the label.

Ladak alfalfa makes large yields the first year, but is so subject to dying out in the summer that it is not recommended in Ohio.

What If a Long-lived Stand Is Desired?—If for any reason it is desired to keep an alfalfa stand more than 3 years, it is desirable to attempt to obtain seed of the wilt-resistant Ranger or Buffalo alfalfas. Seed of both is extremely scarce, especially of Buffalo. When seed is available, present indications are that Buffalo will be slightly better in the southern two-thirds of the state and Ranger at least as good or perhaps slightly better in the northern third. However, the difference between the two is not important. Both are resistant to bacterial wilt and, hence, will furnish good yields for 4, 5, 6 or more years.

What Is the Basis for These Recommendations?—Two factors make the above recommendations differ somewhat from those made 20 to 25 years ago. First, in those 25 or 30 years of extensive alfalfa experience in Ohio, we have learned that resistance to the direct effect of cold is not usually important in Ohio. Experimentally, this has been important just once in the last 25 years. There is considerable winterkilling of alfalfa in Ohio, but most of it is due to heaving from freezing and thawing on poorly drained soils. Grimm and other variegated alfalfas are no more resistant to heaving than common alfalfas.

The second factor is bacterial wilt of alfalfa. This is a new and extremely important factor in alfalfa production in Ohio and in the United States. This disease of alfalfa roots develops very slowly. It always permits a good crop for 1 year, usually for 2 years, and frequently for 3 years before it reduces the stand to the unprofitable point. Wilt is caused by bacteria which obtain entrance to the roots through mechanical injury, either from freezing, from implements, or from insects. It has been difficult to predict outbreaks of wilt. In most instances, wilt develops more rapidly in the lower, flatter fields and parts of fields. There has been less trouble from wilt in southeastern than in northwestern Ohio, but the disease is now generally distributed over the State. Even plowing up a field, which has been killed by wilt, and seeding it back to alfalfa immediately has not always resulted in rapid development of wilt in the ensuing stand, although, obviously, the practice is not to be recommended.

Recognizing Bacterial Wilt.—Bacterial wilt is most easily recognized in the fall. At this time, severely affected plants throw up a multitude of weak, slender, short, yellow branches, as compared to the few strong, green shoots of healthy alfalfa (Fig. 1). The same contrast appears after the first and second cuttings, but less conspicuously. After the first sharp frost, plants severely affected by bacterial wilt will be frosted while healthy plants will be uninjured. If weak-looking plants in such a field are dug and the roots cut across diagonally with a knife or the bark peeled from the roots, the color of the wood layer will be varying shades of brown instead of the clear white of healthy roots.

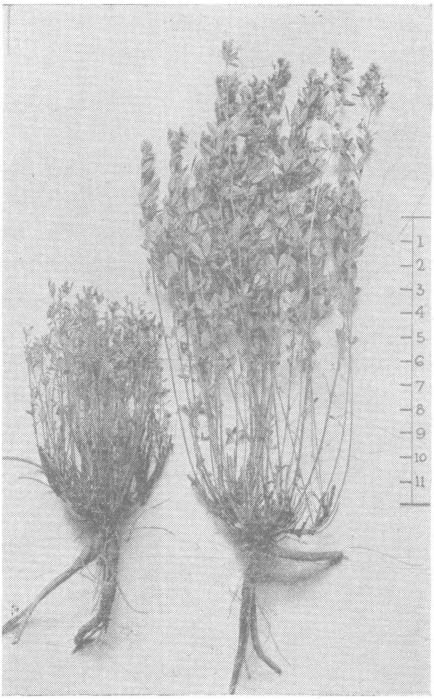

Fig. 1.—Bacterial wilt of alfalfa. September 9.—Left, typical alfalfa plant affected by bacterial wilt; right, normal plant dug less than one foot from the diseased plant.

These severely affected plants will die during the winter and the man who is not acquainted with bacterial wilt naturally attributes the loss to winterkilling. Much recent "winterkilling" of alfalfa was really caused by bacterial wilt.

Wilt-resistant Varieties.—The disease developed in the western states before it developed in Ohio. Breeding programs to produce wilt-resistant varieties have been under way for more than 15 years. Ranger and Buffalo are products of these programs. Ranger is a synthetic variety or blend of selected wilt-resistant strains from several sources, both common alfalfas and variegated alfalfas. It is not a typical variegated alfalfa and in northern Ohio in the first year or two will not usually yield as much as the variegated alfalfas. Buffalo is a straight selection from Kansas Common and except for its wilt resistance, behaves like Kansas Common and is adapted where Kansas Common is. There are some other older wilt-resistant varieties, but they are commercially unobtainable, and not recommended for Ohio.

The only advantage that Ranger and Buffalo have is their resistance to bacterial wilt. Unless it is essential that your alfalfa stand last for 4 years or more, you should not pay the very high price now asked for seed of these varieties, especially if you have

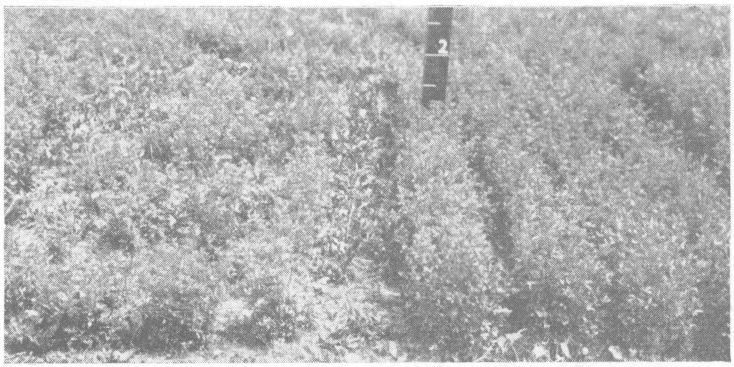

Fig. 2.—Columbus, June 28, 1944. Sown in 1940. Left, Hardigan. Right, Ranger.

been generally unsuccessful in growing alfalfa. You will have no better luck with Ranger or Buffalo than with the older varieties. First, learn to grow alfalfa. Then, if you definitely have difficulty with bacterial wilt, and need to keep a stand for 4 to 6 years, get one of these wilt-resistant varieties, if available.

Fig. 3.—Columbus, July 11, 1944. Sown in 1941. Left, Buffalo. Right, Baltic.

Experiments Where Bacterial Wilt Is the Deciding Factor.—The history of a typical variety test under wilt infestation at Columbus gives an indication of what to expect under these conditions. Table 1 below shows yields of 7 of the 17 varieties in this test, sown in 1941. Yields have not been taken since 1945 but the test was standing in 1947, and the wilt-resistant strains certainly made over 3 tons per acre. Notice that while the variegated varieties outyielded the common varieties in the year after seeding, in the third year after seeding the common varieties considerably outyielded the variegated, and in the fourth year after seeding the common varieties yielded nearly three times as much as the variegated. This is because the common varieties are uniformly more resistant to bacterial wilt than the variegated varieties. Grimm, Baltic, and Hardigan (Fig. 2) are the commercial varieties most susceptible to bacterial wilt. Notice the variegated variety, Baltic, which ranked first in 1942 and last in 1944 and 1945 (Fig. 3).

Table 1.—Alfalfa Variety Test, Sown at Columbus in 1941
Two cuttings each year.

Variety	Yield per Acre			Rank		
	1942	1944	1945	1942	1944	1945
	Tons	Tons	Tons			
Baltic	3.18	1.28	.42	1	17	17
Kansas Common	3.16	2.14	1.11	2	11	12
Buffalo	3.06	3.02	3.34	6	1	2
Ranger	3.06	2.79	3.48	7	3	1
Grimm (Northwest.)	3.04	1.74	.70	8	13	14
Hardigan	3.00	1.36	.44	9	16	16
Oklahoma Common	2.71	2.01	1.48	15	12	11
Av. Variegated	3.07	1.46	.52			
Av. Common	2.94	2.07	1.30			
Av. Wilt-resistant	3.06	2.90	3.41			